OILSEED RAPE and TURNIP RAPE

Family: Cruciferae

Genus : *Brassica*

Specie: *napus* (oilseed), *rapa* (turnip)

(i) General background on the plant

The oilseed and turnip rapes exist in two forms and are grown in cool temperate regions such as Northern Europe. The winter rapes are sown during the last 10 days of August and the first 10 days of September and harvested the following July, and the faster growing spring rapes sown in Northern Europe during late March and early April being harvested mid-August to September. Rape exists as annual and biennial plants. Both oilseed and turnip rape have a tuberous tap root. Each plant has a number of racemes on which yellow flowers are carried. The height of the crop varies depending upon the variety and is typically between 70-250 cm.

The main types of oilseed rape (OSR) grown at present:

- **Double low (00) varieties, were originally grown for food and contain low levels (typically less than 1%) of erucic acid (which humans find hard to digest), and low levels of glucosinolates (a sulphur compound which makes the meal by-product indigestible for animals). Current uses of `00` varieties include oil for human consumption, and high protein meal for animal feed. Industrial uses including feedstocks for pharmaceuticals and hydraulic oils.**
- **High erucic acid rape (HEAR) varieties, are grown specifically for their erucic acid content - typically 50-60% of oil. In 1995 36,423ha of HEAR was grown in Europe, of which 13,234ha was produced in the UK. The principal end use of HEAR is to produce erucamide, a `slip agent` used in polythene manufacture, with a small proportion (~2,000ha) used to produce behenyl alcohol, which is added to a waxy crude mineral oil to improve its flow.**

The plants are 60-70% self pollinated but can be cross-pollinated. Rapes can cross with other wild *Brassicae* such as charlock and wild mustards. This affects glucosinolate content of the resulting seed and hence there are strict rules governing rape seed product to maintain genetic purity, especially of double low varieties. Varieties low in glucosinolates may be palatable to grazing pests such as pigeons and hares and may be more susceptible to attack from such pests.

Soils rich in sulphur can lead to raised levels of glucosinolates in the rape seed and foliage as can climatic conditions (Merrien, 1989).

TURNIP RAPE

Early ripening spring turnip rapes (*Brassica rapa*) have been developed in Canada and Scandinavia where extreme winter conditions and short growing seasons preclude the use of autumn sown rape.

Autumn turnip rapes seem to be a promising alternative to northern growers with successful establishment possible well after the latest safe drilling dates for autumn swede rape and once again will mature about three weeks earlier. Varieties seen so far in observation plots have been

relatively weak stemmed. No assessments of yield potential were available from National Institute Agricultural Botany (NIAB) trials in 1995.

Turnip rapes meet the same quality standards for oil and cake as swede rape with low erucic acid and low glucosinolates (Double low).

(ii) Details of quality characters

Glucosinolate Content - Varies considerably between sites and seasons. Arable area aid Payment Scheme (AAPS) is available on oilseed rape, grown from certified seed of approved varieties, for which the average content must not exceed 25 micromoles/gram.

Erucic acid - Low erucic varieties are those in which erucic acid constitutes 2% or less of the measured fatty acids (National Institute of Agricultural Botany, NIAB 1995). Oil with high erucic acid content is valuable as an industrial lubricant, and is eligible for growing on set-aside land under contract terms to merchants.

00 - Double low varieties conform to the standard of low glucosinolate and low erucic acid.

Rape seed varieties with High Erucic Acid content (HEAR) are valuable as an industrial lubricant, and are eligible for growing on set-aside as well as land eligible for under the AAPS.

TYPICAL OIL CONTENTS OF TURNIP RAPE AND OILSEED RAPE (%) :

	Rape seed oil	
Oil type	**Oil Content %**	**Single and 00 OSR vars**
Palmitoleic (C16:1)	**32**	**ca. 60**
Linoleic (C18:2)	**15**	**ca. 30**
Linolenic (C18:3)	**1**	**10**
Erucic (C22:1)	**50**	**<1**

(iii) Current production and yields : crop production statistics 1997

Country	Area harvested '000 ha	Yield t/ha
Austria	54.90	1.86
Belgium / Luxembourg	8.00	2.75
Denmark	106.00	2.78
France	61.5	3.53
Finland	988.00	1.50
Germany	918.00	3.10
Greece	n/a	n/a
Ireland	4.00	2.50
Italy	40.30	1.99
Netherlands	1.00	3.00
Portugal	n/a	n/a
Spain	48.70	1.54
Sweden	63.00	1.91
UK	414.00	3.50

(Source : FAO 1997)

(iv) Constraints upon production.

Rotational considerations might limit potential expansion. Politically European production is controlled by the GATT agreements and financial penalties can be imposed if either total sown areas of oil crops (Sunflower, OSR and Soya) exceeds 5.128 million hectares, or meal production from industrial cropping rises above 1 million tonnes.

(v) Markets and market potential;

Double low Varieties

The main uses for rapeseed oil is in cooking oils or margarines with the rape meal being used for animal feed.

Canola quality rape seed (Double low varieties) which have almost no nutritionally undesirable long chain fatty acids can still be improved further by decreasing the linolenate content on average form about 10% to 3%, to give an enhanced shelf life. For industrial applications a very high content of oleic acid (80-90%) is preferred due to its suitability for certain chemical

reactions and ease of extraction

High Erucic Acid Rape seed (HEAR) looks exactly the same as conventional '00' rape, but the oil content is different. HEAR oil contains approximately 50% erucic acid ('00' rape contains less than 2%). HEAR oil has special properties, including high smoke and flash points, oiliness and stability at high temperatures, ability to remain fluid at relatively low temperatures and durability. HEAR oil is used to produce erucamide which is used as a slip additive in polythene and polypropylene, to reduce surface friction and prevent adhesion between film surfaces. HEAR oil is also used in printing inks, lubricants and has a range of other industrial applications.

Rape seed oil is currently incorporated into lubricants for two stroke petrol engines and rape seed oil - derived methyl esters can be used as a diesel substitute, although this application is currently uneconomic in Europe due to the low cost of mineral-derived diesel oil. Subsidies are required to make rape methyl ester competitive.

Possible markets for oilseed rape varieties:

Timescale	Variety type	Industrial use	Market size (ha)
Available now	Double low	Pharmaceuticals	30 000
	High-erucic/high-glucosinolate	Polythene slip agent	14 000 declining
	High-erucic/low-glucosinolate	Waxy crude-oil flow improver	2000 increasing
	Double low/high-erucic	Hydraulic oils	Potentially large
Available within five years	High-lauric	Detergents, food	Potentially 40 000
	High-linoleic	Paints	48 000 (with high linolenic)
	High-linolenic	Paints	
Available after five years	Ultra-high erucic	Polymers, cosmetics	>160 000
		pharmaceuticals, inks	
	High-ricinoleic	Lubricants, plasticisers,	£100 m in France/UK
		cosmetics	

Source: Carruthers, S.P., Miller, F.A., and Vaughan, C.M.A. 1994

(vi) Other information

Oilseed rape yield and quality can be affected by a number of fungal diseases, the most significant of which are canker (*Leptosphaeria maculans*), light leaf spot (*Pyrenopziza brassicae*, asexual stage *Cylindrosporium concentricum*), downy mildew (*Peronospora parasitica*), alternaria (*Alternaria brassicae*), sclerotinia (*Sclerotinia sclerotiorum*), clubroot (*Plasmodiophora brassicae*)

and white leaf spot (*Pseudocercosporella capsellae*). Three aphid transmitted viruses can infect rape, beet western yellows virus is most common, followed by turnip mosaic virus and cauliflower mosaic virus. Pollen beetle can also be a problem and must be controlled by a spray programme.

Oilseed utilization in Europe by Pascal Cogels, Director General, FEDIOL, Brussels, Belgium

Genetic Manipulation - oilseed rape is at the forefront of genetic engineering technology and several varietal types have successfully completed trials and await EU approval for commercial release. The developments are of two major types, those with enhanced or altered quality characteristics or those with pest, disease or herbicide tolerance. The first trait likely to be available commercially in the EU is glufosinate ammonium herbicide tolerance, followed by glyphosate tolerant oilseed rape and varieties with modified fatty acid content, in particular high lauric acid rapeseed. The introduction of these varietal types will require careful planning and is at present the subject of much debate.

UK Government announces fuller evaluations of growing genetically modified crops, 21 October 1998

UK Code of Practice on the provision of information relating to genetically modified crops
An article by BSPB, NFU and UKASTA

See the following pages in the NF-2000 Database

Oilseed rape (Brassica napus ssp. oleifera)

AGRE-0010 - The Methyl Esters of Rapeseed: New Industrial Outlets for Agriculture

AGRE-0039 - Seed Oils for New Technical Applications SONCA

FAIR-PL97-3884 - CTVO-NET Chemical-technical utilisation of vegetable oils

UK Government Funded R&D on Crops for Industrial and Energy Uses: Section 1 - Industrial Oils and Fatty Acids

AIR2-CT93-0879 - Pod Shatter in Rape
Second progress report AIR-CT93-0879

FAIR-3072 - Engineering shatter resistance into oilseed rape

AGRE-0061 - The Whole Crop Biorefinery Project

FAIR-0627 - Advanced Combustion Research for Energy from Vegetable Oils ACREVO

FAIR-0260 - High Quality Oils, Proteins and Bioactive Products for Food and Non-Food Purposes Based on Biorefining of Cruciferous Oilseed Crops

FAIR-2025 - Increase of Performance of Natural Regrowing Oils to Lubricate Earthmoving Equipment

AIR3-CT94-2063 - Vegetable Oils and their Fatty Acid Esters (VOFA) as Substitutes for Organic Solvents in Industrial Processes (VOFAUSE)

FAIR-1625 - New Valorisation of Rapeseed/Sunflower Lecithins, in Cosmetic and Fermentation Industries - AVAIL

(vii) Contacts

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(viii) References

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NIAB Oilseeds variety Handbook. NIAB recommended and descriptive lists of oilseed crops 1995.

Carruthers, S.P., Miller, F.A., and Vaughan, C.M.A 1994 Crops for industry and energy. Centre for Agricultural Strategy.